

THURSDAY, MAY 10, 1906.

THE CELL IN MODERN BIOLOGY.

Allgemeine Biologie. Die Zelle und die Gewebe.

Second edition. By Oscar Hertwig. Pp. xvi+648;

371 illustrations. (Jena: Gustav Fischer, 1906.)

Price 15 marks.

THE volume before us appears as the second edition of the author's well known treatise on the cell, the first part of which was published so long ago as 1892.

Cytology has advanced a good deal since that time, and one finds a significant recognition of its wider scope in the new title—"General Biology"—given by Prof. Hertwig to his book. Experience is showing that the larger problems connected with living things, such as organisation, heredity, function, as well as those abnormal reactions constituting what we call pathology, are all reducible to cell problems.

For the most complex living creature is resolvable into groups of more or less modified cells, and the latter are not merely bound together like faggots in a bundle, but each group, each cell it may be, in so far as it is the seat of chemical or physical change, is able in greater or less degree to exert an influence on other individuals of the cell community. In this way there arise those adjusted relationships that exist between different organs, tissues, and cells which we designate as correlations, and it is just because of the existence of these inter-dependent cellular reactivities that complex organisation has come to be a possibility.

One of the chief aims of Prof. Hertwig's book is to trace the cell in its manifold variety of form and its diverse conditions of activity, especially with reference to the part it plays as a corporate unit of the organism. It is perhaps inevitable that such a task should prove too great for any single writer to accomplish satisfactorily throughout, and, indeed, the present work is by no means free from the faults of its ambition. Some aspects of the subject are exceedingly well treated, others are left comparatively untouched, while in the case of yet others the standpoint taken up perhaps hardly represents that of contemporary thought. The last criticism especially applies to the discussion of some of the physiological attributes of cell life. Again, the more recently studied phenomena of apospory, apogamy, and parthenogenesis, with their general bearings on the processes of meiosis and fertilisation, are very scantily dealt with. The work is decidedly strongest on the morphological side, although even here the treatment seems to suffer from want of the physiological relationships involved.

A considerable portion of the book is occupied with discussions as to the connection that may subsist between the facts of cell structure and the phenomena of ontogeny and heredity. Brief accounts are given of the standpoints adopted and the theories advocated by other writers, and Hertwig adds another of his own, which he terms biogenesis.

It is not very easy to extract the author's exact position with regard to biogenesis, and nowhere in

the volume does the theory appear to be summarised and presented in a succinct and complete form. But the doctrine it seems to embody is that development and specialisation of function, with the corresponding segregation of structure, are due to the correlative action of the parts on one another coupled with the influence of agencies operating from without—i.e. of the environmental conditions. It is this speculative part of the treatise, suggestive and interesting as it is, that will probably provoke the greatest antagonism. Hertwig is a thorough believer in the inheritance of acquired characters, though it seems not improbable that many will dissent from the interpretations he puts on cases that he apparently regards as critical ones.

The example of the supposed inheritance of immunity against the poisonous action of ricin, shown by Ehrlich to occur in the case of the offspring of mice under certain conditions, can hardly be accepted as satisfactory evidence of the "inheritance of acquired characters" as the phrase is critically understood. Indeed, it seems to break down altogether when the conditions under which it may be observed are examined and analysed. Mice are excessively sensitive to the effects of ricin, very minute doses being sufficient to bring about the death of the animal. But by repeated inoculation of sublethal doses of the poison a mouse may reach a state of immunity against the action of a quantity far greater than that which normally proves fatal. The offspring of female immunised mice are themselves also immune, at least during early life, whereas the young resulting from a cross between an immune male and an ordinary female do not exhibit the transmission of the "acquired character." In other words, the transmission is confined to the female side. It is evident, however, that such a case is really of no value whatever as evidence of transmission of acquired characters in the proper acceptance of the term. For it is manifest that the young animal during the whole of its existence *in utero* has been directly exposed to influences that ought to confer immunity upon it, apart altogether from any question of "transmission." Furthermore, it might well be that the bulky protoplasm of the egg, irrespective of the maternal influence after conception, may have been affected without any disturbance of the hereditary mechanism, and, indeed, Hertwig himself admits as much.

The case of certain Lepidoptera is more difficult of satisfactory explanation, although the evidence would probably be insufficient to convince an opponent. Some of these insects respond to different climatal conditions by the production of different colour-patterns on their wings. Now if the pupæ of some species (e.g. *Arctia caja*) be subjected to cold, the "cold" form of imago will appear, and if the fertile eggs of such "cold" forms be raised under warmer conditions, a small percentage of the perfect insects thus produced will retain the characters of the "cold" form. Hertwig dissents from the explanation, suggested by Weismann, that the eggs themselves may have been affected whilst still in the body of the

parent insect in the pupal condition, but his argument does not amount to much; and it may well be borne in mind that an example of somewhat analogous character is afforded by the alternative characters exhibited by the leaves and other structures of many amphibious plants. Many of these can assume one of two different forms, the production of either depending on the stimulus given by the environment to the embryonic tissues at the growing points. Thus the form of, say, a leaf of such a plant is determined at a very early stage in its development, and long before it is sufficiently advanced for any functionally direct adaptation to a terrestrial or to an aquatic environment. But when once the stimulus has operated, subsequent removal to opposite conditions does not result in a corresponding alteration in the future development of such a leaf—it belongs definitely to the aquatic or to the terrestrial type, whichever line of ontogeny it embarked on from the first. It would seem, at any rate for the present, and in the absence of sufficient experimental evidence to the contrary, more natural to regard these di- or polymorphic species as “balanced” forms; the actual course of their ontogeny, whilst restricted to certain directions, and confined within definite limits, depending on the alternative character of some metabolic activity. This is, however, very different from an admission of the “inheritance of acquired characters.” For if anything at all is meant by the expression, it can only imply that the hereditary mechanism has itself undergone a definite and corresponding change; and at present a direct influence of the environment in this sense is negated by the results of the most critically conducted experiments on breeding.

Hertwig takes up a definite position as to the relation of the “somatic” to the “germ” cells. He regards all the cells of the body as fundamentally equivalent, though differentiation may mask and finally render impossible the return of a particular cell to the embryonic state. The definite tissue cell has become specialised rather as the result of an impulse from without than by a segregative process of analysis; and herein he is diametrically opposed to Weismann and his followers, in regarding cellular differentiation as a secondary rather than as a primary matter. In this he will find many who are at one with him, for the “erbungleich” division postulated by Weismann, which would result in development consisting of a sorting out or analysis of the characters of the germ, conflicts with many facts of experience, and it is only by numerous “Hilfshypothesen” that it can be sustained for the plant and vegetable kingdoms.

In a notice of a book like this one of Hertwig's, it is natural that the points on which diversity of opinion prevails should occupy a relatively prominent place. But such treatment is in no way intended to detract from or to minimise the great value of the work, coming as it does from one who has himself done so much to advance the subject of which he writes, and whose lucid and suggestive treatment of his theme will always command attention. It is a book that should be read by all who are interested in the questions of modern biology.

J. B. FARMER.

APPRECIATIONS OF HAECKEL.

- (1) *Ernst Haeckel: Der Mann und sein Werk.* By Carl W. Neumann. Pp. 80. (Berlin: Gose and Tetzlaff, n.d.) Price 1.50 marks.
- (2) *Haeckel: His Life and Work.* By Wilhelm Bölsche, with introduction and supplementary chapter by the translator, Joseph McCabe. Pp. 336; illustrated. (London: T. Fisher Unwin, 1906.) Price 15s. net.
- (3) *Last Words on Evolution: a Popular Retrospect and Summary.* By Ernst Haeckel. Translated from the second edition by Joseph McCabe. Pp. 127; with portrait and three plates. (London: A. Owen and Co., 1906.) Price 6s.

(1) **M**ANY who know Prof. Haeckel only as the author of zoological memoirs, evolutionist essays, and monistic propaganda, will be glad of the opportunity which this brightly written booklet affords of becoming more closely acquainted with the man himself and with the story of his life. We read with interest of the eager boy-naturalist wandering on the Siebengebirge, of the apprenticeship under Johannes Müller, of the year of medical practice (if a man can practise on three patients!), of the eventful year in Italy during which Haeckel nearly became a landscape painter, of the growing fascination which the plankton exerted, satisfying at once his artistic and scientific interests, of the influence that the “Origin of Species” had on him, and of his early settlement in Jena—that “feste Burg freien Denkens”—which nothing could ever induce him to leave. At the Stettin Versammlung in 1863 Haeckel entered the lists as a champion of the evolutionist “Weltanschauung,” contending almost single-handed against contempt and prejudice. His cause, which eventually prevailed, as the truth must, had to be fought for, and those who are offended by the impetuous expressions of Haeckel's “Stürmernatur” are profitably reminded by this little book of the courage and indefatigability of perhaps the most virile protagonist of a thesis which has been one of the greatest contributions made by science to human progress. The author has told the story of Haeckel's life and work with vividness and enthusiasm. He concludes his effective sketch by indicating, somewhat too tersely and vaguely, how it has been possible for him to use the truth that is in Haeckel in developing a monistic philosophy more satisfying to the human spirit.

(2) Prof. W. Bölsche's study of Ernst Haeckel is, like the frontispiece to the book, a picture in warm colours. The author is nothing if not enthusiastic, and indeed no one can think over the achievements of Haeckel's life without sharing the author's admiration for his hero. If it be true, as the translator says, that “a hundred Haeckels, grotesque in their unlikeness to each other, circulate in our midst to-day,” this “plain study of his personality and the growth of his ideas” should go far to replace them by giving us an appreciation approximately true. We should not ourselves have called Bölsche's book, as Mr. McCabe does, a “plain study,” for its characteristic features are exuberant enthusiasm and a brilliantly